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The Virtual Wave Observatory:

A Portal for Planetary Radio and Plasma Wave Data

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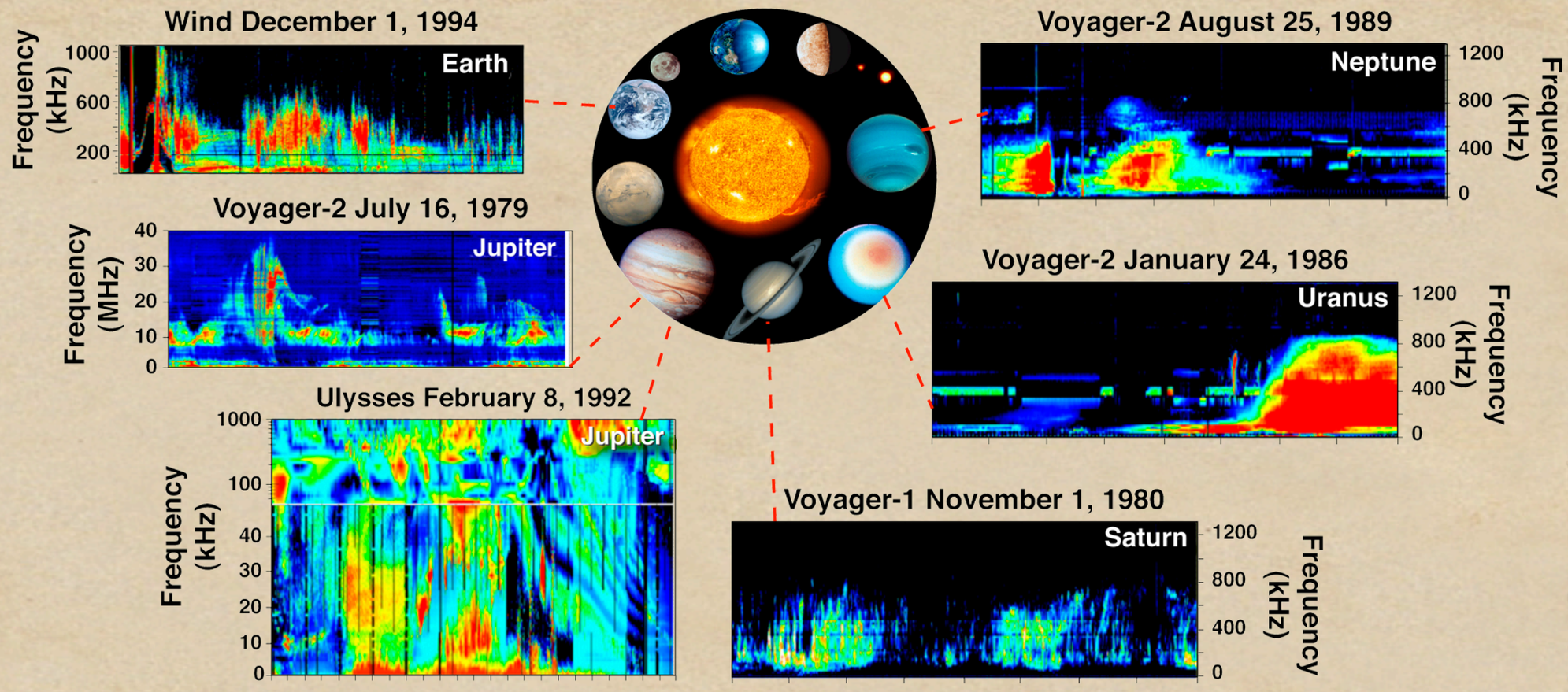
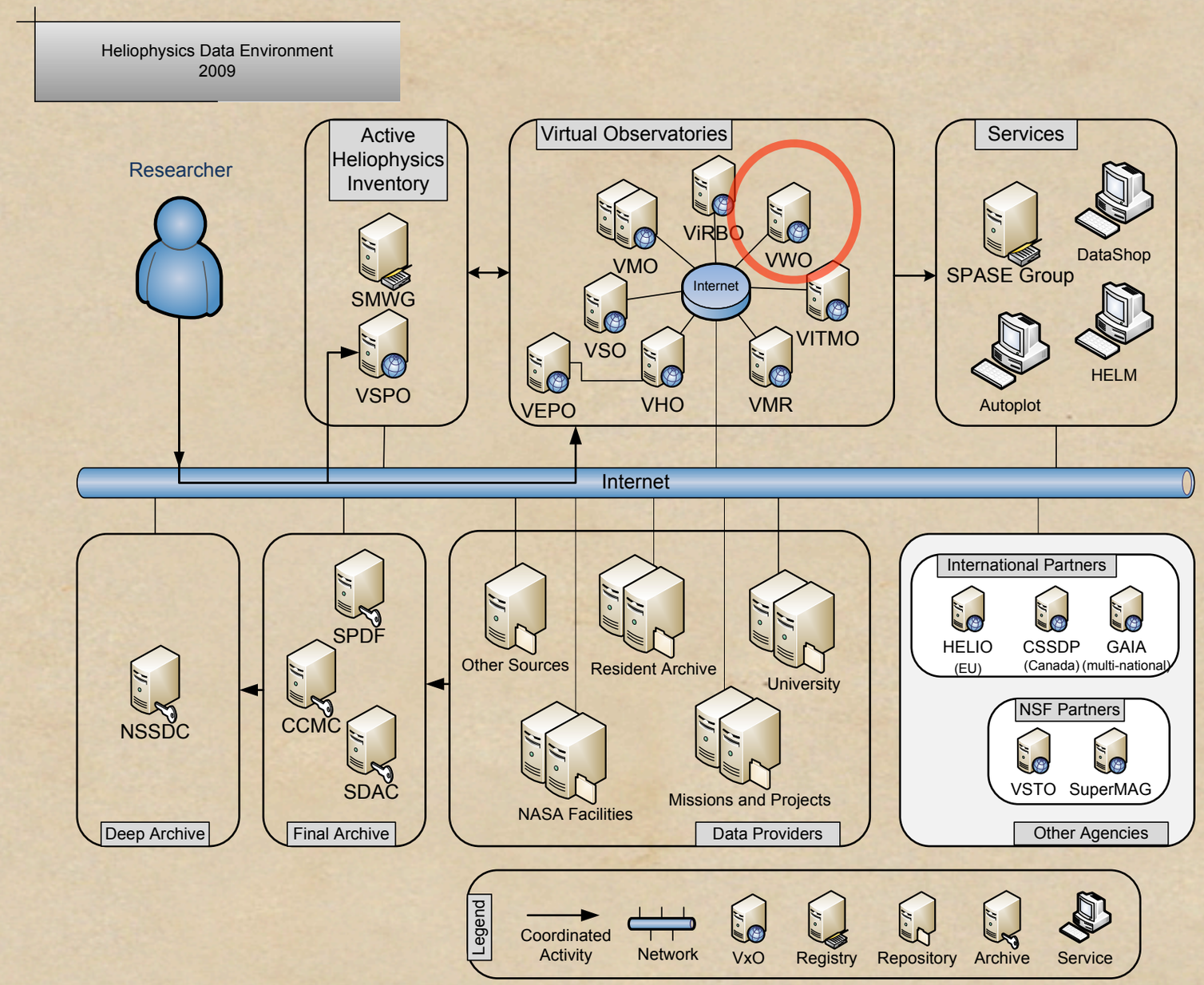


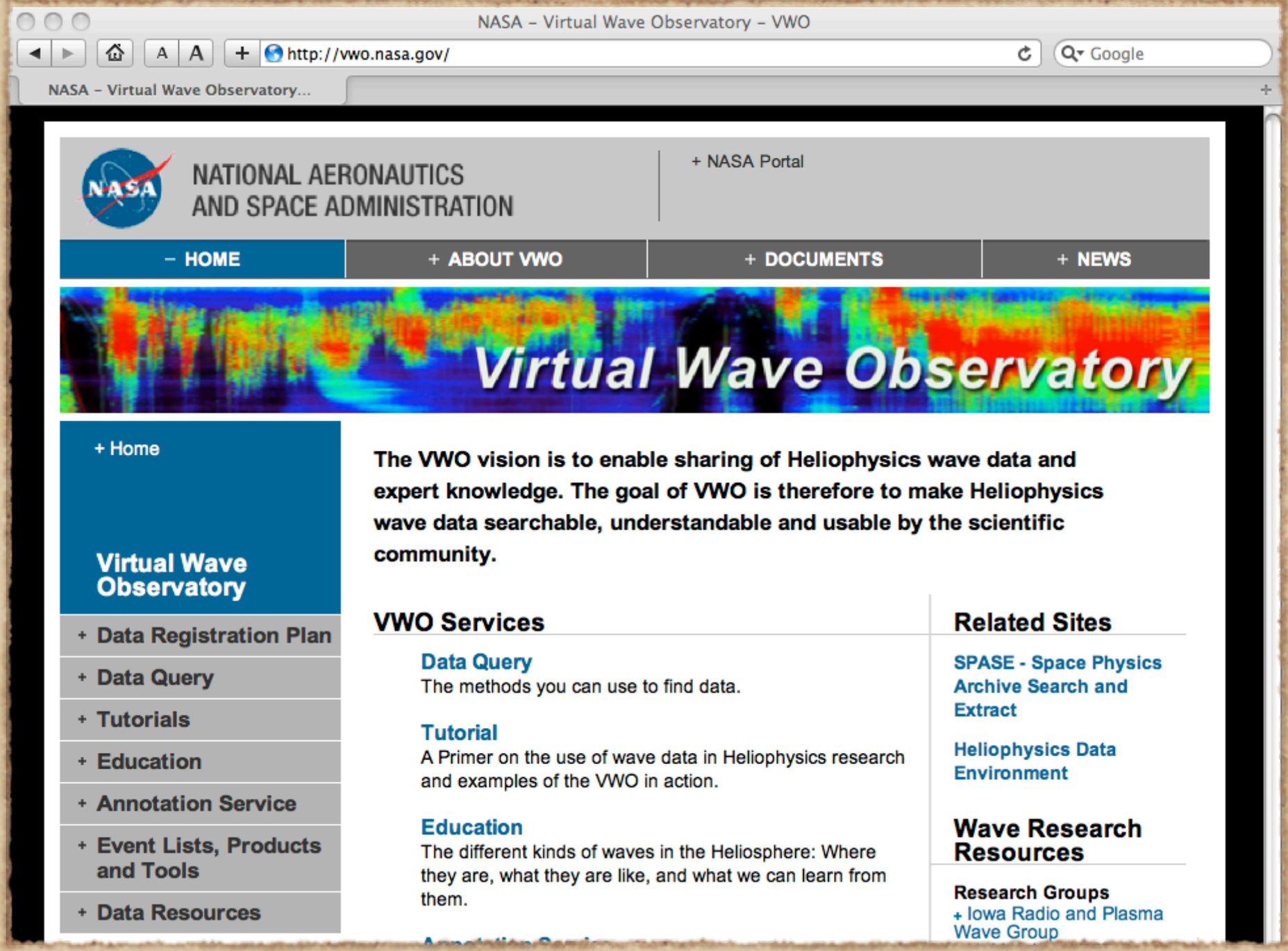
Wave phenomena are ubiquitous throughout the Solar System

The goal of the Virtual Wave Observatory (*VWO*) is to make all online Heliophysics wave data searchable, usable and understandable by the scientific community.

VWO and NASA's Heliophysics Data Environment



Begun in 2009, *VWO* is one of several discipline-specific virtual observatories (VxOs) within the Heliophysics Data and Model Consortium (HDMC). NASA's HDMC oversees VxOs and Resident Archives.



Visit the Virtual Wave Observatory

http://vwo.nasa.gov

Metadata in the SPASE Data Model

- SPASE (Space Physics Archive Search and Extract) Data Model provides common keywords and dictionaries to enable searches in distributed data archives.
- VWO works with the SPASE group to define terms for describing wave data.
- VWO is actively creating descriptions of wave data products.

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VWO Data Registration Effort

The first Heliophysics data sets *VWO* is describing are those for Earth's radio and plasma wave environment.

We will also support the Planetary Radio and Plasma Wave community with data sets from:

- *Voyager* PRA & PWS
- *Ulysses* URAP
- *Galileo* PWS
- *Cassini* RPWS

Satellite Mission (Experiment/Data types)	Time Span
Polar (PWI/ waveform, spectrogram)	1996-1997
IMAGE (RPI/ spectrogram, plasmagram)	2000-2005
Cluster (DWP, EFW, STAFF, Whisper/spectrogram)	2001-present
Cluster (WBD/ waveform)	2001-present
Geotail (PWI)	1992-present
THEMIS	2007-present
Alouette 2 (Sounder/ digital ionograms)	1965-1975
ISIS 1 (Sounder/ digital ionograms)	1969-1984
ISIS 2 (Sounder/ digital ionograms)	1971-1984
DE 1 (PWI/ spectrogram)	1981-1990
Ulysses (URAP/spectrogram, waveform, direction)	1990-2008
Wind (Waves/ spectrogram)	1994-present
STEREO (Swaves/ spectrogram)	2006-present
Voyager 1 & 2 (PRA/spectrogram)	1977-1989
Voyager 1 & 2 (PWS/spectrogram)	1978-2000
Galileo (PWS/ spectrogram)	1989-2003
Cassini (RPWS/spectrogram)	1997-present
Hawkeye (ELF-VLF/spectrogram)	1974-1978
ISEE 1 & 2 (Plasma wave, VLF)	1977-1987
ISEE 3/ICE (Plasma wave spectrum analyzer)	1978-1997
ISEE 3/ICE (Radio mapping of Solar Wind disturbances)	1978-1997
CRRES (Plasma wave)	1990-1991

Ground-based (Experiment/Data types)	Time Span
Augsburg College AGO (Searchcoil Magnetometer /spectrograms)	1993-2008
U. Maryland AGO (Magnetometer, Riometer & VLF /Survey plots)	1986-2005
Augsburg College Svalbard (Searchcoil Magnetometer /spectrograms)	2006-2008
NCAR Svalbard (Searchcoil Magnetometer /daily data files)	2006-2008

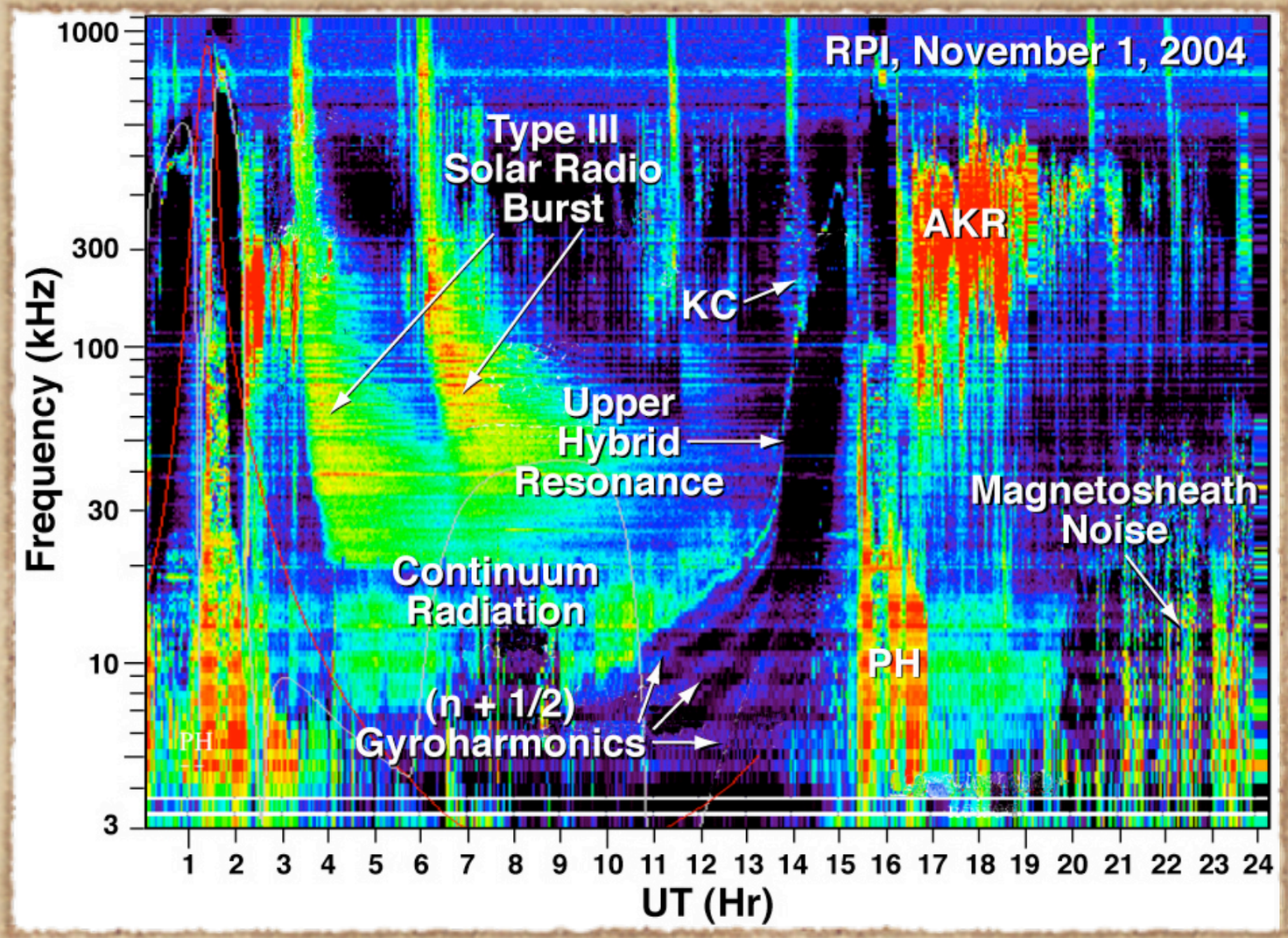
Searches by Context

- Natural wave emissions in the Earth's magnetosphere are often dependent on the state (i.e. context) of the magnetosphere.
- *VWO* has enabled searches on time-shifted solar wind, IMF and geomagnetic conditions.
- As an example, correlations have been shown between Saturn SKR and solar wind (Desch and Rucker, 1983).

Searches by Phenomenon (Under Development)

- In order to help broaden the use of wave data to non-wave experts, *VWO* intends to develop a service to capture data annotations provided by wave experts as they analyze the data

- These annotations will then be stored in a searchable database to enable searches by these wave phenomena.



- **Success of this service depends on community input.**

Cooperation with other VxOs

- The VWO uses the SPASE-Query Language (SPASE-QL, *http://spaseql.gsfc.nasa.gov*) to support seamless and transparent interactions with other VxOs to obtain matches to user search queries.
- This communication method will also allow users to access ancillary data not served by the VWO (for example particle and DC field data or models).

Interacting with the VWO

- The VWO is meeting with the wave research community to ensure that our search tools respond to their needs.
- The VWO is working with data providers to ensure accuracy and completeness of data descriptions.
- The VWO web site will accept feedback from users.
- The VWO will depend on community involvement for development of the annotation service.

Additional Information

- Fung, S. F., *The Virtual Wave Observatory (VWO): A Portal to Heliophysics Wave Data*, Radio Science Bulletin, No. 332, pp. 89-102, March 2010.

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